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PROJECT 798401/221

FLASHTUBE WATERLIGHT PHOTOMETRIC TESTS

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FIELD TESTING AND DEVELOPMENT CENTER

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UNITED STATES COAST GUARD

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PROJECT 798401/221

FLASHTUBE WATERLIGHT PHOTOMETRIC TESTS

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ABSTRACT

Photometric measurements are reported for a prototype model of a "COSLITE Automatic Waterlight." Measurements on the flashing incandescent float light include integrated intensity and effective intensity at 85 different directions, intensity as a function of time over the flash duration and flash rate. All measurements were repeated after the first 15 hours of continuous operation.

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INTRODUCTION:

The COSLITE Automatic Electric Waterlight tested herein is one of a continuing series of waterlights tested for conformity to U. S. Coast Guard Specifications for Floating Electric Water Lights for Merchant Vessels, 46 (CFR) 161.010 of 29 October 1969. The light evaluated in this report is a prototype which was submitted for preliminary intensity tests only.

MATERIALS EVALUATED:

Figure 1 shows an overall view of the COSLITE Automatic Electric Waterlight. The waterlight is powered by an Eveready No. 2746N, 6 volt battery which is used to flash a GE 427 lamp at a nominal rate of 50-70 flashes per minute. Figure 2 shows details of the mounting bracket and socket for the lamp. A plastic lens which also acts as a sealed cover is shown in Figure 3.

TESTS CONDUCTED:

The COSLITE waterlight was tested for flashrate at the beginning and end of a 15 hour test period. The integrated intensity was measured at 85 selected positions which included the total upper hemisphere and the area included within 15 degrees below the horizon. Integrated intensity was measured at a distance of 150 feet with an EGG 585-66 photometer. Integrated intensity was averaged over 10 flashes at each location. Measurements were taken every 30° in azimuth at elevations of-15°, 0°, 15°, 30°, 45°, 60°, and 75°. One measurement was taken at 90° elevation (looking straight down at the light as it would float in the water). The photometer was calibrated by use of secondary standards traceable to the NBS.

Intensity as a function of time during the flash was measured at the beginning and end of a 15 hour test period. The output of the S-10 photomultiplier of the EGG 585-66 photometer was displayed on an oscilloscope and photographed. The integrated intensity was also sampled at the end of 15 hours of operation.

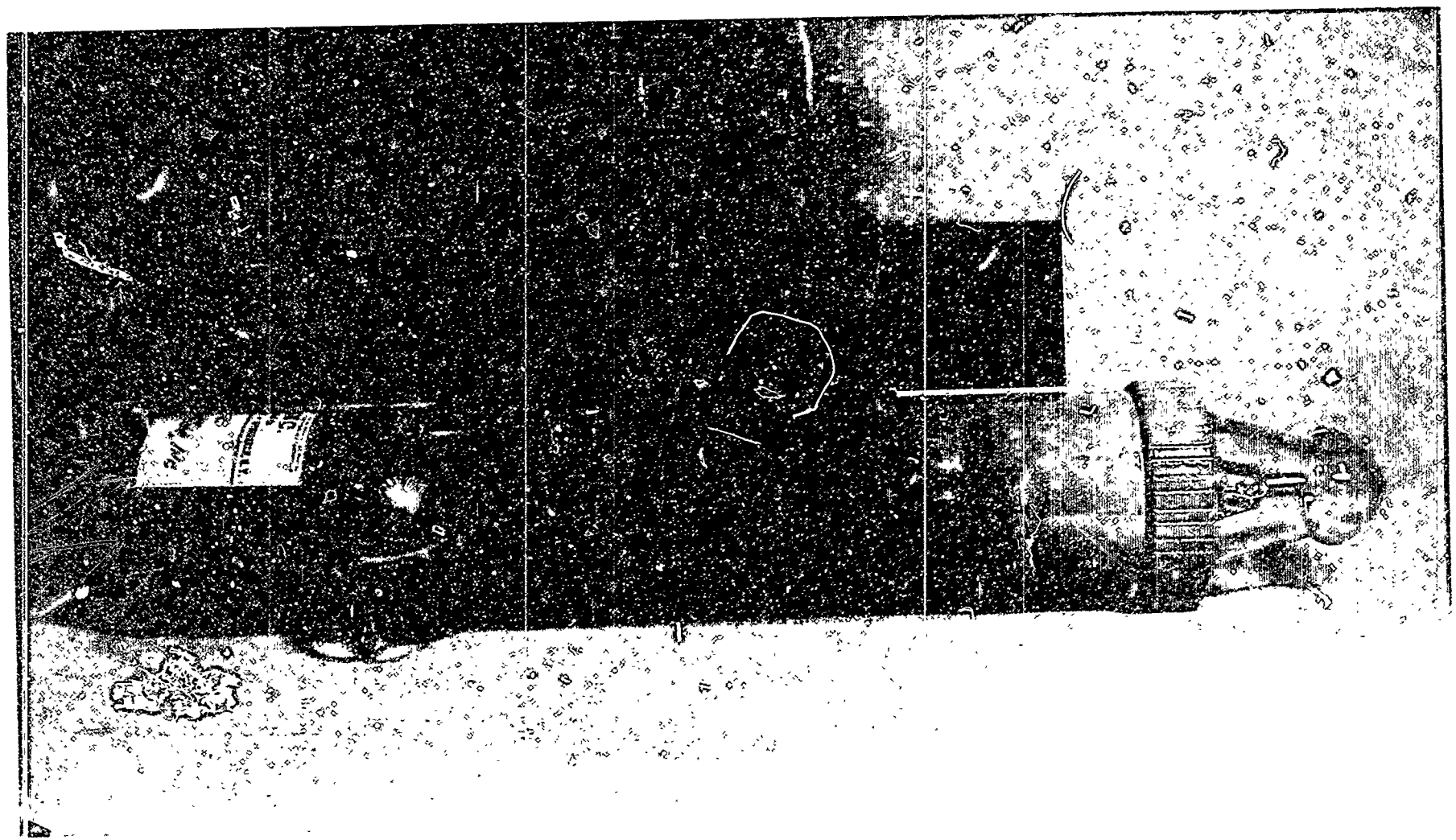

FIGURE 1

Coslite Automatic Electric Waterlight

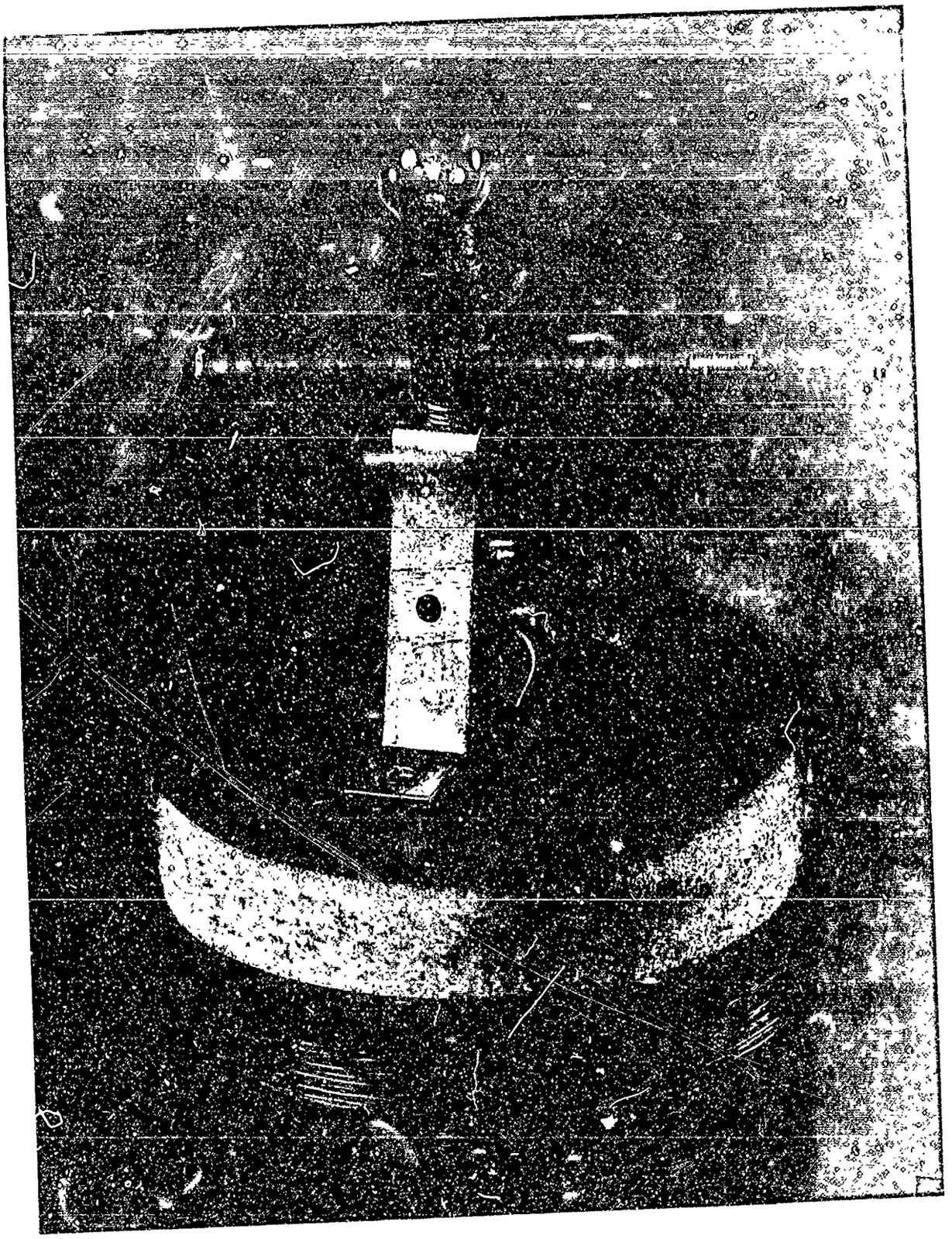

FIGURE 2

Mounting Details of the GE-427 Incandescent Lamp

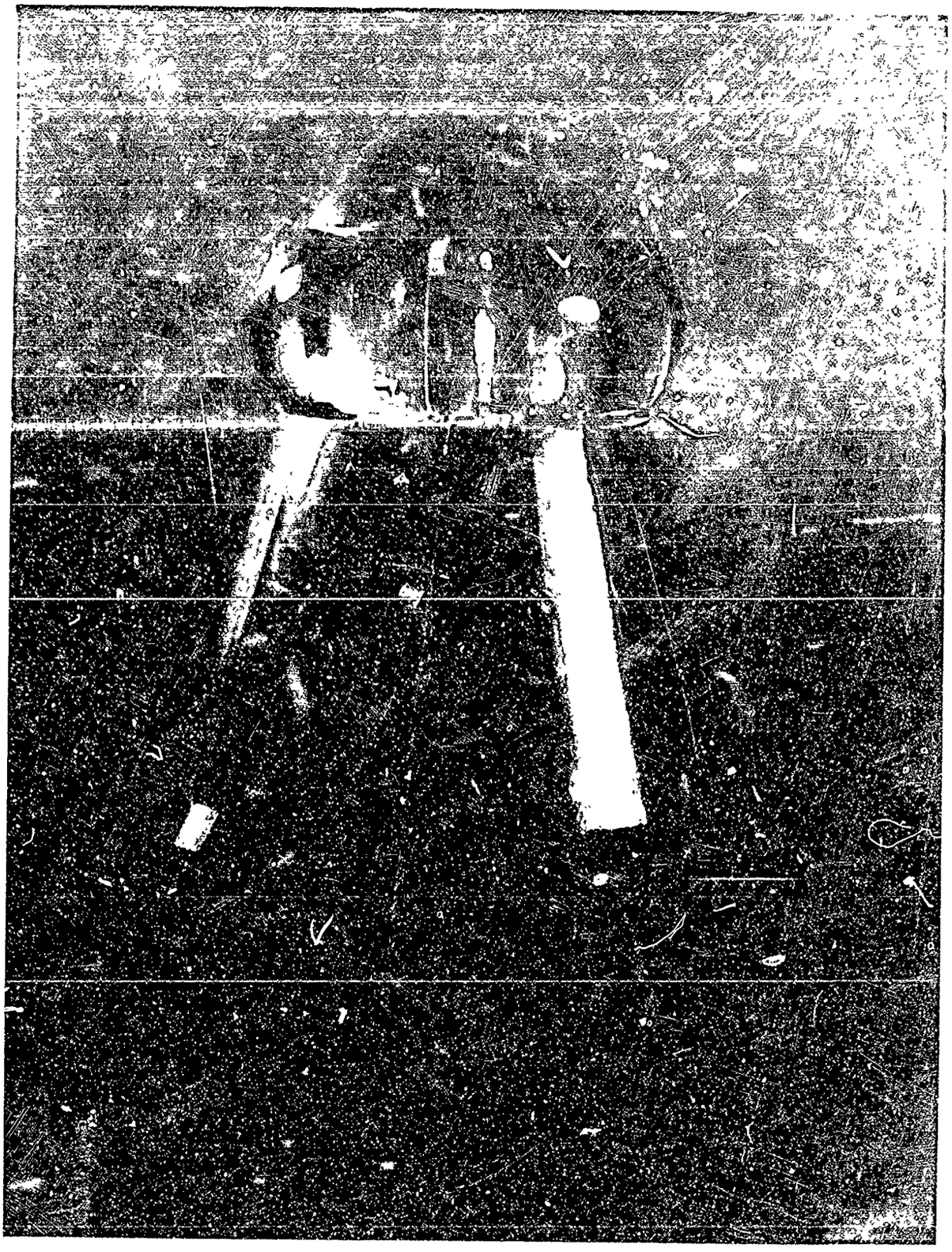

FIGURE 3

Details of the Plastic Lens of the Coslite

TEST RESULTS:

Table 1 lists the values of integrated energy for the coordinates listed. After operating for a period of 15 hours the mean integrated intensity was reduced by 72% from the values measured at the start of the test program.

Figure 4 illustrates the intensity profile over the flash duration of the waterlight with a fresh battery and lamp. Figure 5 is the intensity profile after 15 hours of continuous operation.

At the start of the test program the light flashed at 76 flashes per minute. After 15 hours the flash rate was 74.

AZIMUTH	ELEVATION							
	90°	75°	60°	45°	30°	15°	0°	-15°
000°	0.88	.467	.34	.56	.15	.18	1.1	.09
030°	-	1.45	.47	.52	.17	.16	.94	.10
060°	-	.767	.61	.49	.19	.22	.67	.09
090°	-	.59	.67	.70	.19	.22	.26	.13
120°	-	.69	.51	.54	.17	.30	.17	.13
150°	-	.88	.52	.65	.14	.29	.13	.11
180°	-	.90	.45	.49	.10	.16	.54	.14
210°	-	1.10	.52	.45	.15	.24	.67	.09
240°	-	1.10	.57	.49	.16	.24	.94	.10
270°	-	1.10	.54	.50	.16	.42	.90	.13
300°	-	1.20	.52	.56	.19	.24	1.40	.06
330°	-	1.60	.64	.32	.18	.20	.80	.07

Integrated Intensity in Upper Hemisphere
- Candela - Seconds

TABLE 1

COSLITE AUTOMATIC ELECTRIC WATERLITE

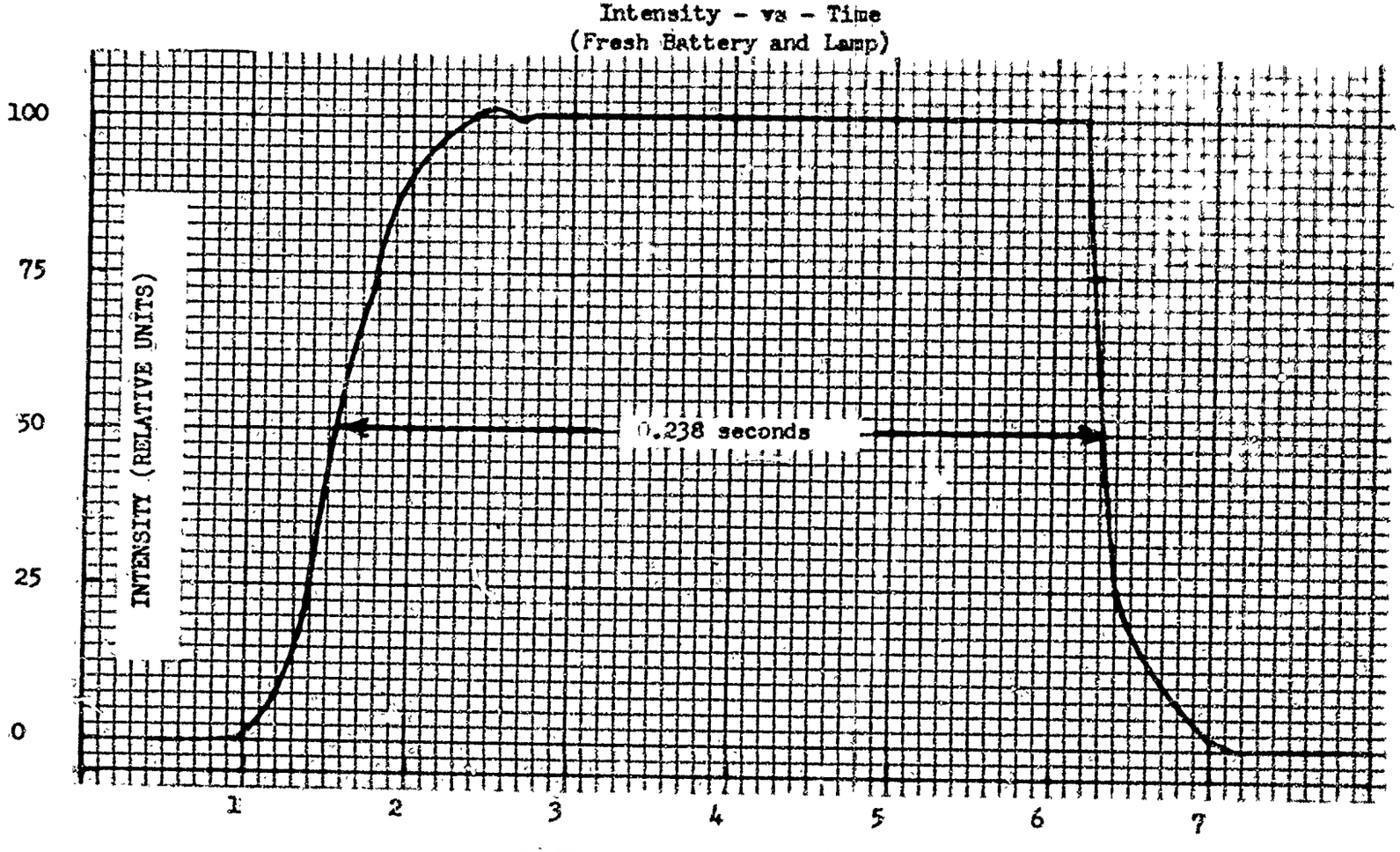

FIGURE 4

COSLITE AUTOMATIC ELECTRIC WATERLITE

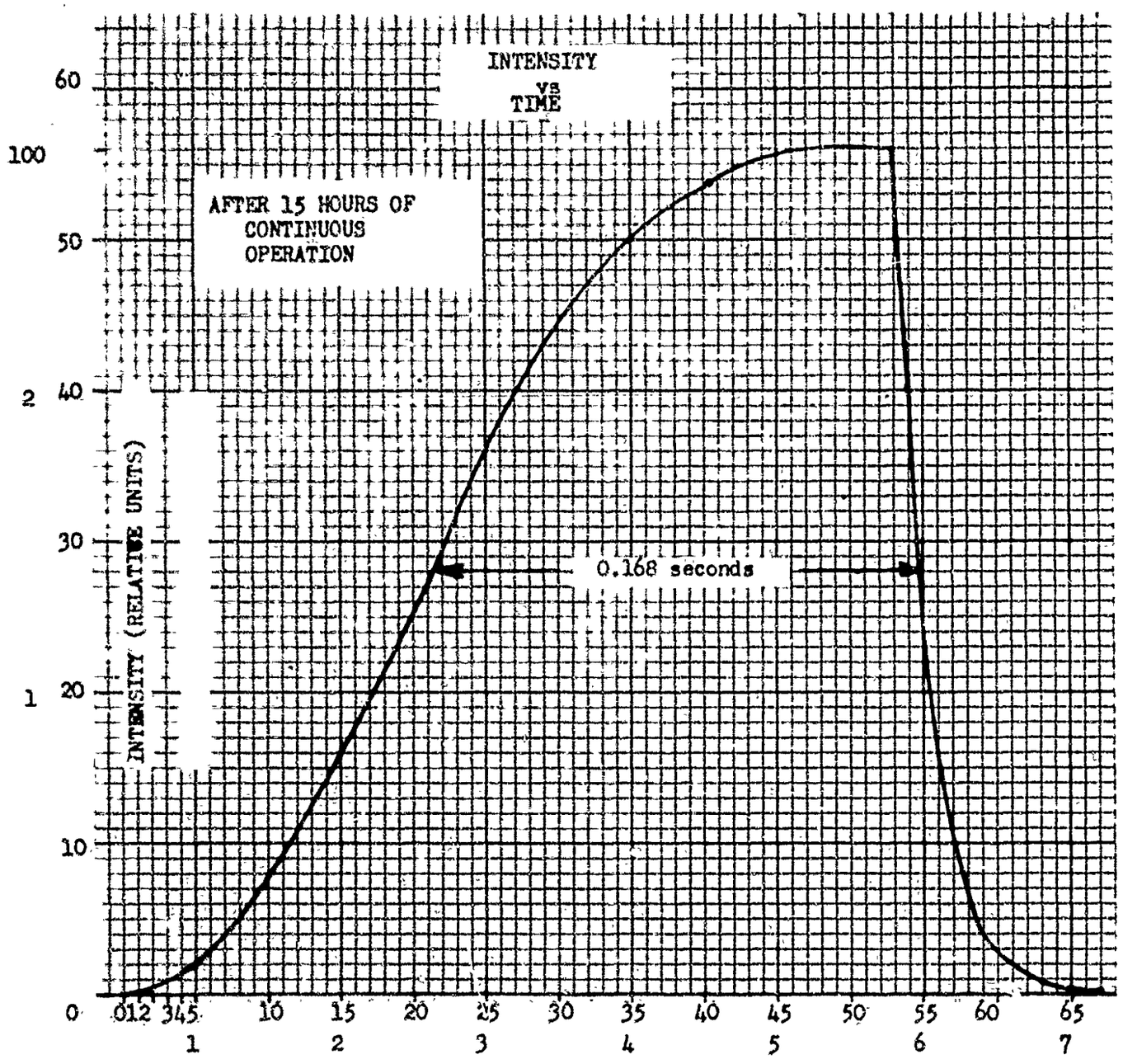

FIGURE 5

CALCULATIONS:

The measurements of integrated intensity and the intensity vs. time curves were used to compute the effective intensity of the waterlight. The effective intensity

$$I_e = \frac{\int_{t_1}^{t_2} I\,dt}{0.2 + (t_2 - t_1)}$$, where I

is the instantaneous intensity of the flash between the time limits t_1 and t_2.

There is a unique solution to the equation for I_e only when the limits of integration t_1 and t_2 are chosen so that they coincide with that value of the instantaneous intensity which equals the effective intensity. The equation was solved by an iteration technique for both intensity profiles listed in Figures 4 and 5. The solution for Figure 4 resulted in an effective flash length of 0.236 seconds and a multiplying factor of 2.15 for the values of total integrated intensity as listed in Table 1. Table 2 incorporates this factor and lists the effective candela at all measured coordinates for the case where the battery was fresh.

Similar calculations resulted in an effective flash length of 0.185 seconds and a multiplying factor of 2.31 for the values of total integrated intensity after 15 hours of continuous operation. Table 3 lists the effective candelas of the COSLITE after 15 hours of operation.

AZIMUTH	ELEVATION							
	90°	75°	60°	45°	30°	15°	0°	-15°
000°	1.89	.981	.731	1.20	.322	.387	2.36	.193
030°	-	3.12	1.01	1.12	.366	.344	2.02	.215
060°	-	1.65	1.31	1.05	.408	.472	1.44	.193
090°	-	1.27	1.44	1.51	.408	.472	.559	.279
120°	-	1.48	1.10	1.16	.366	.645	.366	.279
150°	-	1.89	1.12	1.40	.301	.623	.280	.236
180°	-	1.93	.968	1.05	.215	.344	1.16	.301
210°	-	2.36	1.12	.967	.322	.515	1.44	.193
240°	-	2.36	1.22	1.05	.344	.515	2.02	.215
270°	-	2.36	1.16	1.07	.344	.903	1.93	.279
300°	-	2.58	1.12	1.20	.408	.515	3.01	.129
330°	-	3.44	1.37	.678	.387	.430	1.72	.151

Effective Intensity in Upper Hemisphere of COSLITE Automatic Electric Waterlight at Start of Test Program

TABLE 2

AZIMUTH	ELEVATION							
	90°	75°	60°	45°	30°	15°	0°	-15°
000°	.575	.306	.222	.366	.0980	.118	.720	.0588
030°	-	.949	.307	.340	.111	.105	.615	.0654
060°	-	.502	.399	.320	.124	.144	.438	.0588
090°	-	.386	.437	.457	.124	.144	.170	.085
120°	-	.451	.333	.353	.111	.196	.111	.085
150°	-	.575	.340	.425	.0915	.190	.085	.072
180°	-	.588	.294	.320	.0654	.105	.353	.0915
210°	-	.720	.340	.294	.0980	.157	.438	.0588
240°	-	.720	.372	.320	.105	.157	.615	.0654
270°	-	.720	.353	.327	.105	.274	.588	.085
300°	-	.785	.340	.366	.124	.157	.915	.0398
330°	-	1.05	.418	.209	.118	.131	.522	.0457

Effective L...ity in Upper Hemisphere of
"COSLITE" Automatic Electric Waterlight after
15 Hours of Operation

TABLE 3

DISCUSSION:

The design of the lens/cover of the COSLITE is inconsistent with the specification requiring minimum integrated intensity in all directions of the upper hemisphere. This lens is designed to alter the luminous output distribution of the light source used by collecting light at all azimuths from -30° to +30° in elevation and forming this into a narrow fairly intense horizontal omnidirectional beam. Table 1 shows the effects of this lens by reduced integrated intensity readings at 30° elevation. The measurements listed in the 0° elevation column show the effects of the narrow horizontal beam produced. This beam was very narrow which caused the photometer to scan through the beam as the light was rotated in azimuth. The beam was not perfectly horizontal due primarily to the lamp being misfocused and misalignment of the waterlight on the goniometer table. No attempt was made to carefully realign the system because the results would be inconsequential in assessing whether or not the specifications were satisfied.

CONCLUSION:

The COSLITE Automatic Electric Waterlight does not meet the intensity and flash rate specifications required by U. S. C. G. Specifications for Floating Electric Waterlights for Merchant Vessels, 46 (CFR) 161.010.

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